

systems. In this case, the snapshot copy facility 76 or the IP replication facility 77 accesses the storage object container file 84 through the UxFS file system 44 in the data mover 26.

Change(s) applied Please replace the paragraph on page 17 line 10 to page 18 line ¹⁰ ~~11~~ with the following to document, amended paragraph:

/J.A.P./

2/25/2011

The network block services driver 74 communicates with the network block services server 75 using a relatively light-weight protocol designed to provide block level remote access of network storage over TCP/IP. This protocol also provides remote control of snapshot copy and IP replication facilities. The network block services server 75 maintains in memory a doubly-linked list of storage objects accessible to clients via their network block services drivers. Each storage object is also linked to a list of any of its snapshot copies. A copy of this list structure is maintained in storage. When the data mover 26 reboots, the NBS server rebuilds the in-memory list structure from the on-disk structure. The data mover 26 also maintains a directory of the storage objects using as keys the file names of the storage object container files. The in-memory list structure and the directory are extended to include the iSCSI SCSI over IP storage objects, so that each iSCSI SCSI over IP storage object is accessible to a client through the SCSI termination 64 or the network block services server 75. In particular, each virtual LUN recognized by the SCSI termination 64 has a corresponding NBS identifier recognized by the network block services server 75 and a corresponding storage object container file name. API calls are provided to coordinate the iSCSI SCSI over IP initiator 66 and the SCSI termination 64 with the NBS protocol during snapshot operations. For example, the snapshot and replication

a Microsoft Exchange platform. In this environment, a Microsoft Exchange server, or a server for a database such as an Oracle or SQL database, typically stores its database component files and tables such as storage groups, and transaction logs to one or more block devices. It is desired to replace these block devices with remote block devices in a network file server, and to provide disaster protection by replicating the database files and transaction logs to a geographically remote network file server and taking read-only copies or snapshots of the database and logs, for backup to tape.

Change(s) applied Please replace the paragraph on page 8 lines ⁷ 11-16 with the following amended to document, paragraph:

/J.A.P./
2/25/2011

For the data processing network in FIG. 2, for example, the client may use iSCSI the SCSI over IP protocol over the IP network 20. In this example, the software modules in the client 23 include application programs 51 layered over an operating system 52. The operating system manages one or more file systems 53. To access the network storage, the file system routines invoke a SCSI device driver 54, which issues SCSI commands to an iSCSI SCSI over IP initiator 55. The iSCSI SCSI over IP initiator inserts the SCSI commands into a TCP connection established by a TCP/IP module 56. The TCP/IP module 56 establishes the TCP connection with the data mover 26, and packages the SCSI commands in IP data packets. A network interface card 57 transmits the IP data packets over the IP network 20 to the data mover 26.